Overview

Through funding provided by the SUI, a learning module on sustainability was developed for students in the design and planning professions and more specifically for the students in the Architecture + Health Program at Clemson University. The learning module was developed from a survey of the existing literature and case study research to cover to gain an understanding of the relationship between architecture, human health and sustainable environments. A total of five content areas formed the learning module and included both substantive content and graphic illustrations. The five areas are as follows: (1) Architecture, health and the environment – The interdependent relationship, (2) Historical review illustrating the relationship between the architecture, health and sustainability, (3) Contemporary context illustrating the relationship between architecture, health and sustainability, (4) Architecture, health and sustainability: Definitions, approaches, delivery tools and life cycle assessment, (5) Architecture, health and sustainability at multiple scales – building, community and global considerations.

Project Description

Buildings, not cars, are the major damagers of the Earth. Pollution from the heating and cooling of buildings exceeds that from cars, even in America. We just don’t see it, except from the chimneys of an older city on a cold Winter day.

Quoted in Enertia Building Systems, Inc. website

Currently in the School of Architecture at Clemson University, there is not a required course or module offered within the curriculum on sustainability. Consequently, the 279 undergraduates and 79 graduates currently enrolled in the architectural program, at this point in time, do not receive any formal education on sustainable issues. As a faculty member in the specialized Architecture + Health program, I have a responsibility to train students to practice health care architecture in a more informed way and sustainability is a valuable component. Since architects are the creators of our built environment, then it is imperative that students, our future architects, be aware of how their attitudes, behavior and actions will impact our natural environment and the health of people.

Therefore, a proposal was submitted to SUI to develop a new learning module on sustainability and implement the module in multiple areas within the architectural curriculum such as seminar courses, design studios, and thesis projects. This proposal specifically targeted the graduate
students in the Architecture + Health program because sustainability ties to our program philosophy\(^1\). The five content areas of the learning module have been integrated into multiple required seminar courses [such as Healthcare Delivery Systems and Facilities Seminar (ARCH 485/685) and/or the Health Facility Components Seminar (ARCH 486/886)] as well as studio courses [such as Arch 854]. The framework established for the five content areas allows for information to continuously be added over time. The learning module may eventually be used to develop a seminar course for the entire School of Architecture.

The **anticipated outcomes** from this learning module were the following:

1. Educate students on sustainability issues to ultimately change attitudes and behaviors.
2. Increase awareness within the planning and design disciplines. Architects should serve as ambassadors to educate clients, and others as to the impact that buildings have on the environment and to create successful examples of sustainable architecture.
3. Identify opportunities for collaboration, research, and teaching with other disciplines such as building sciences, environmental engineering, environmental policy, environmental ethics, and environmental medicine.

The Need for a Learning Module

Sustainable or “green” architecture impacts us both economically and environmentally. Economically, sustainable architecture produces reduced energy consumption (both direct operating costs and embodied energy). Environmentally, sustainable architecture impacts both our *shared* environment as well as our *personal* environment. Our shared environment can be improved if buildings are designed to reduce their impact on air, water, landfills, and nonrenewable resources. Our personal environment can be improved if buildings are better designed for indoor air quality and day lighting. Since the average American spends approximately 95% of their time in a day indoors, improving the shared and personal environments can ultimately improve our health and well-being. Furthermore, according to the Environmental Protection Agency, over $60 billion dollars per year in medical costs in the United States can be attributed to the poor quality of the interior environment (Zeiher 1996).

All architects are mandated to protect the health, safety, and welfare of a building’s occupants. But it is healthcare facilities that must, by their very nature, support health and wellbeing. For often it is the people within these facilities who are the most susceptible to poor environmental conditions (depressed immune systems, stress, etc.). Since health is due, in part, to environment, creating a place that nurtures both physical health as well as emotional health is essential. This is the responsibility of healthcare architects.

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\(^1\) The Architecture + Health (A + H) Program at Clemson University is recognized as one of the leading architectural training studios in the nation and is one of only two programs in the county that focuses on issues related to architecture + health. Established in 1968, the A + H Program has celebrated years of success due to its dedicated faculty, its specialized curriculum, and its strong connection to practice.
Healthcare architects are also responsible for how their work promotes a community’s health (both local and global). This broader definition of health reminds us that the actions we take in architecture have consequences beyond the building’s occupants. And it is through sustainable architecture that architecture reaches beyond the building’s site and impacts our larger community. Many of the basic tenants of sustainable architecture walk hand in hand with those of healthcare architecture. The two promote one another. It is this reason the learning module is necessary for faculty and students in the Architecture + Health program. Without this knowledge, a student of healthcare architecture is not fully prepared to design responsible built environments.

Methods

The learning module was developed with the assistance of a qualified student research assistant and parallel efforts in one of the seminar courses in the Architecture + Health program (ARCH 685). First, the literature was reviewed and the content areas most applicable to architectural design, health and sustainability were identified, discussed and refined over time. The information for each of the content areas was developed using multiple sources including literary sources, web sites, experts in the field, as well as resources through the Sustainable Universities Initiatives. During this research phase, case studies were identified and analyzed to supplement each content area with examples of successful applications. Building examples were documented in digital format for the purpose of illustrating key points discovered during the research and analysis. Finally, the relevant information and building examples were synthesized into a cohesive learning module for students in the Architecture + Health program. The framework established lends itself for the addition of information over time.

Outcomes and Benefits

The target audience for this learning module on sustainability is planning and design disciplines. A total of five content areas were developed for the learning module on sustainability, architecture and health and an outline of the topics covered are noted below:

1. Architecture, Human Health and the Environment – An Overview
   - Introduction to architecture, human health, and environment
   - Evidence on connections between architecture, human health and ecology
   - Patterns of change: Building trends, health trends, and environmental trends
   - Cultural influences on the relationship between architecture, human health and environment

2. Historical Review on Architecture, Human Health and Sustainable Environments – (consumption, resource depletion, public health and ecological destruction versus preservation)
   - Greco-Roman Era: Human and Natural Ecological Sensitivities – respect for nature, agricultural focus, origins of healing environments,
• Modern Era: Rise of the Scientific Method– quantification, empiricism, and industrialization

• Twentieth Century and the Post Modern: Technological Marvels and the Humanistic Perspective.

3. Contemporary Context of Architecture, Human Health and Sustainable Environments – (from 1970s until today)

• A need for Action
  i. Concerns voiced regarding sustainability (e.g. Carson’s book on *Silent Spring*, energy crisis, United Nations Conference on the Human Environment in 1972, 1973 Mideast Oil Embargo, Eco-friendly design, hermetically sealed buildings, growth of synthetic materials and environments)

  ii. Population growth and overpopulation

  iii. Impact of the built environment (architecture) on human health (personal and shared environment) – Changes in types of illness as evidenced in population health indicators (shift from infectious diseases to chronic, degenerative diseases such as cancer, heart disease, asthma, diabetes, obesity, etc). Architecture contributes to health problems through planning practices, land-use patterns, construction, energy use, pollution, waste, etc.

  iv. Changes in environmental quality and human health – water quality, air quality, climate change, biodiversity, human created ecosystems, etc.

• Recognition of Unsustainable Practices Today (priority areas – sustainability with a health perspective)
  i. Uncontrolled growth, sprawl – environmental impact and health impact

  ii. High energy consuming building typologies (Commercial, healthcare, educational and housing)

  iii. Overall consumption patterns and the culprits

• Pathways to Sustainable Future
  i. What has been addressed? What has not been addressed? What is working and what is not working?

4. Architecture, Health and Sustainability Overview –approaches, delivery tools, and life cycle assessment

• Introduction – Sustainable definitions, historical concerns and contemporary considerations

• Approaches to sustainable design – ecological approaches

• Architectural sustainable concerns and considerations – energy, site, water, air, materials, thermal building characteristics, technology, climate.
• The built environment and energy consumption—overview of energy sources. Non renewable (fossil fuel combustion (85% of all energy is produced by fossil fuel combustion E&A) and renewable (energy generated from water, wind, sun, biomass and waste, hydrogen, nuclear, space energy)

• Sustainable assessment tools - LEED, Life cycle assessment

5. **Health and Sustainability matrix – Individual (I), Community (C), and Global (G) scales. I+I+I+I…= C, and C+C+C+C…= G**

• At the individual scale – Indoor Air Quality, Indoor Environmental Quality and Psychosocial Factors (I)
  ii. Light – natural and artificial
  iii. Thermal comfort – temperature and humidity
  iv. Connections to nature – views and therapeutic qualities
  v. Control – ability to change the environment to satisfy individual preferences

• At the community scale – (C)
  i. Physical Environment
     1. Buildings (four building types are explored – healthcare, office, education, residential)
        a. Energy Consumption (gas, electric, renewable)
        b. Waste Management
        c. Pollution Production
     2. Infrastructure (in between and connections to)
        a. Transportation Systems
        b. Supply services
        c. Waste Management
        d. Land-use development (sprawl and current growth patterns, planning practices, and regulations)
     3. Natural Environment (access, views, connections, etc.)
        a. Parks
        b. Lakes
        c. Agriculture
        d. Reserves
ii. Public Health Initiatives and Health Promoting Movements (services, programs, and policies)

- At the global scale – (G) (consequences: \( I + C = G \))
  - i. Global Warming (climate and atmospheric change)
  - ii. Deforestation
  - iii. Aquatic Preservation
  - iv. Extinction/Acid Rain

**Post Grant Activities – Outgrowth of work**

Several activities have been directly and indirectly related to the work that was developed for this learning module. These activities are noted below:

- Submission of an article to the Planning Forum Journal entitled, “Linking Health to the Built Environment: Learning from Historical Precedents.”

- Currently developing a book proposal with faculty from Landscape Architecture, and Urban Planning on the influence of Medical Thought on Environmental Design during the Progressive Era to expand on some of the findings discovered during the research.

- A review of the literature clearly demonstrates a need for a book on the topic of the health components related to sustainable and unsustainable design. An article on “Architecture, Human Health and the Sustainable Environments” is being considered.

- A proposal has been requested from the Oak Hill Fund following a letter submission outlining a project to investigate sustainable housing prototypes for the affordable housing market (particularly needed for the growing older population).

- The research conducted during this grant aided in the development of the Symposium entitled *Health By Design* held in Charleston in Fall 2003. SUI was a significant partner of this Symposium.